

## CLAIMS

I claim:

1 1. A magnetic head comprising:  
2 a free magnetic layer;  
3 a bias layer having a width and being disposed parallel to the free magnetic layer  
4 and configured to induce a bias magnetic field in the free magnetic layer; and  
5 a bias pinning layer disposed parallel to the bias layer, having a width that is  
6 greater than the bias layer width, and configured to induce a stabilization magnetic field  
7 in the bias layer.

1 2. A magnetic head according to claim 1, wherein the width of the bias pinning layer  
2 is at least three times the width of the bias layer.

1 3. A magnetic head according to claim 1, wherein the bias pinning layer includes  
2 cobalt samarium (CoSm) or cobalt platinum chromium (CoPtCr).

1 4. A magnetic head according to claim 1, wherein the bias pinning layer includes  
2 cobalt samarium having between 60 at.% and 95 at.% cobalt and between 40 at.% and 5  
3 at.% samarium.

1 5. A magnetic head according to claim 1, wherein the bias pinning layer includes

2      cobalt platinum chromium having between approximately 80 at.% and 68 at.% cobalt,  
3      approximately 12 at.% platinum, and between approximately 8 at.% and 20 at.%  
4      chromium.

1      6.      A magnetic head according to claim 1, wherein the bias pinning layer has a  
2      thickness that is between approximately 10 angstroms ( $\text{\AA}$ ) and approximately 50  $\text{\AA}$ .

1      7.      A magnetic head according to claim 1, wherein:  
2              the bias pinning layer includes a bias pinning material and has a bias pinning  
3      thickness; and  
4              the bias pinning material and the bias pinning thickness are selected such that the  
5      bias pinning layer has high coercivity and high resistivity.

1      8.      A magnetic head according to claim 1, further including a pinned magnetic layer  
2      structure having a width that is substantially greater than a width of the free magnetic  
3      layer.

1      9.      A magnetic head according to claim 1, further including:  
2              an anti-ferromagnetic layer having a width that is substantially greater than a  
3      width of the free layer; and  
4              a pinned magnetic layer structure having a width that is substantially greater than  
5      the width of the free magnetic layer.

1 10. A magnetic head according to claim 9 wherein the width of the pinned magnetic  
2 layer structure is at least three times the width of the free magnetic layer.

1 11. A magnetic head according to claim 1, further including a pinned magnetic layer  
2 structure including a first pinned magnetic layer, an antiparallel coupling layer and a  
3 second pinned magnetic layer, wherein said second pinned magnetic layer has a width  
4 that is approximately equal to a width of the free magnetic layer and the first pinned  
5 magnetic layer has a width that is at least three times the width of the second pinned  
6 magnetic layer.

1 12. A hard disk drive for reading and writing information in a magnetic medium, the  
2 disk drive comprising:

3 a disk having a surface that includes the magnetic medium;  
4 a motor coupled to rotate the disk;  
5 a slider having an air bearing surface;  
6 an actuator configured to hold the air bearing surface of the slider proximate to  
7 the surface of the disk;

8 a magnetic head disposed within the slider and forming part of the air bearing  
9 surface, wherein the magnetic head includes:

10 i) a free magnetic layer;  
11 ii) a bias layer having a width and being disposed parallel to the free  
12 magnetic layer and configured to induce a bias magnetic field in the free magnetic

13                   layer; and

14                   iii)           a bias pinning layer disposed parallel to the free magnetic layer and the  
15                   bias layer, having a width that is greater than the bias layer width, and configured  
16                   to induce a stabilization magnetic field in the bias layer.

1           13.       A hard disk drive according to claim 12, wherein the width of the bias pinning  
2           layer is at least three times the width of the bias layer.

1           14.       A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2           cobalt samarium (CoSm) or cobalt platinum chromium (CoPtCr).

1           15.       A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2           cobalt samarium having between 60 at.% and 95 at.% cobalt and between 40 at.% and 5  
3           at.% samarium.

1           16.       A hard disk drive according to claim 12, wherein the bias pinning layer includes  
2           cobalt platinum chromium having between approximately 80 at.% and 68 at.% cobalt,  
3           approximately 12 at.% platinum, and between approximately 8 at.% and 20 at.%  
4           chromium.

1           17.       A hard disk drive according to claim 12, wherein the bias pinning layer has a  
2           thickness that is between approximately 10 angstroms ( $\text{\AA}$ ) and approximately 50  $\text{\AA}$ .

- 1 18. A hard disk drive according to claim 12, wherein:
  - 2 the bias pinning layer includes a bias pinning material and has a bias pinning
  - 3 thickness; and
  - 4 the bias pinning material and the bias pinning thickness are selected such that the
  - 5 bias pinning layer has high coercivity and high resistivity.
- 1 19. A hard disk drive according to claim 12, further including a pinned magnetic layer
- 2 structure having a width that is substantially greater than a width of the free magnetic
- 3 layer.
- 1 20. A hard disk drive according to claim 12, further including:
  - 2 an anti-ferromagnetic layer having a width that is substantially greater than a
  - 3 width of the free layer; and
  - 4 a pinned magnetic layer structure having a width that is substantially greater than
  - 5 the width of the free magnetic layer.
- 1 21. A hard disk drive according to claim 20 wherein the width of the pinned magnetic
- 2 layer structure is at least three times the width of the free magnetic layer.
- 1 22. A hard disk drive according to claim 12, further including a pinned magnetic layer
- 2 structure including a first pinned magnetic layer, an antiparallel coupling layer and a
- 3 second pinned magnetic layer, wherein said second pinned magnetic layer has a width

4 that is approximately equal to a width of the free magnetic layer and the first pinned  
5 magnetic layer has a width that is at least three times the width of the second pinned  
6 magnetic layer.

1 23. A method for fabricating a magnetic head, comprising:

2 depositing a plurality of sensor layers, including:

3 i) a pinned magnetic layer;

4 ii) a spacer layer;

5 iii) a free magnetic layer;

6 iv) a bias spacer layer; and

7 v) a bias layer;

8 removing outer portions of a plurality of layers, including the spacer layer, the  
9 free magnetic layer, the bias spacer layer, and the bias layer;

10 depositing an electrical lead layer upon outer portions of the pinned magnetic  
11 layer; and

12 depositing a bias pinning layer upon the bias layer.

1 23. The method of claim 22, the removing of outer portions of the layers further  
2 includes removing outer portions of the bias pinning layer.

1 24. The method of claim 22, the removing of outer portions of the layers further  
2 includes removing outer portions of the pinned magnetic layer.

- 1 25. The method of claim 22, wherein:
- 2       the pinned magnetic layer includes a first pinned magnetic layer, an anti-parallel
- 3       coupling layer, and a second pinned magnetic layer;
- 4       the removing of outer portions of the layers further includes removing outer
- 5       portions of the first pinned magnetic layer, the anti-parallel coupling layer, and the
- 6       second pinned magnetic layer.